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ABSTRACT

Two studies of graduate students living in a 13-story dormitory examined the effects of natural lighting, usable space, sex, culture, and floor height on perceptions of spaciousness, personalization of space, crowding, and lightness. Previous research had indicated differences between males and females in this area, but had not considered cultural differences. Eighty single room residents completed questionnaires about their perceptions of space and crowding. Results indicated that students did not vary by sex in their perceptions of lightness. Variations in usable space produced differences in rated spaciousness, personalization of space via covering walls with decorations, and crowding. Students from Mediterranean cultures judged their rooms as more crowded than did students from Asian cultures. Although the rooms located on higher floors had better views, residents on higher floors reported higher stress levels. More research is recommended and suggestions for possible areas of study are indicated. (Author/IS)

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MODIFIERS OF PERCEIVED SPACIOUSNESS AND CROWDING AMONG DIFFERENT CULTURAL GROUPS

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by

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ABSTRACT

Two studies of graduate students (80 and 117) residing in a 13-story dormitory were completed to examine the effects of natural lighting, usable space, sex, culture and floor height on ratings of spaciousness, personalization, crowding and lightness. Rated lightness varied with natural lighting and was associated with rated crowding. Variations in usable space produced differences in rated spaciousness, personalization and crowding. Students from Mediterranean cultures judged their rooms as more crowded than did students from Asian cultures. Although view improved with increases in floor, residents on higher floors reported higher stress levels.

MODIFIERS OF PERCEIVED SPACIOUSNESS AND CROWDING AMONG DIFFERENT CULTURAL GROUPS

Humans may experience crowding discomfort from living in dense interior spaces (see reviews by Stokols, 1979 and Kirmeyer, 1978). Thus, students in dormitories may feel crowded: They live, work, entertain guests and sleep in a room which is frequently less than 10 square meters per person. Certainly, additional space would be desirable, but, because of costs, more space is not likely. Instead, designers, managers and residents must find ways to make the room feel larger and less crowded through the manipulation of non-spatial elements.

Do non spatial elements effect perceived size and crowding? In two important percursor to this research, Schiffenbauer et al. (1977) and Mandel et al. (1980) examined the effects of non spatial elements on perceived spaciousness and crowding. Schiffenbauer et al. (1977) surveyed <u>female</u> residents in a 12 story dorm, and found that that rated room size was higher for rooms higher in usable space. Rated crowding and lightness was affected by the amount of natural lighting in the room. Space and crowding were unrelated. In contrast, Mandel et al. (1980) studied <u>males</u> and <u>females</u>. They found that <u>only</u> among the females did natural lighting display effects: It affected rated lightness and correlated with rated crowding and room size. For both sexes, <u>physical</u> crowding correlated with perceived room size. That the males and females in this study lived in separate dormitories, and that the elevator in the males' dormitory was

less reliable should not be overlooked. Were there other unobserved differences between the buildings? Could the differences in response between males and females result from differences between the buildings rather than male/female differences? This is an important question for environment-behavior research. We have accepted research findings from populations in one or two environments (such as the dorms cited above), without questioning whether unique physical properties of the research setting produced the results. To examine the question of gender vs. environmental differences, this research centered on males and females living in one dorm. We expected that in the same living conditions, both males and females would exhibit similar patterns of response.

This research differed from Schiffenbaur et al. (1977) and Mandel et al. (1980) in several other ways. First, unlike their use of double-occupancy rooms, this study centered on single roors. As was noted by Mandel et al. (1980), density has two components--spatial, referring to amount of space, and social, referring to number of people. Now, consider Valins and Baum's (1973) finding that decreased control of social stimulation results in increased sensitivity to social crowding. Students living alone should have more control over social stimulation than their counterparts with roommates. Thus they would be less sensitive to social crowding. The presences of roommates in the earlier studies may have reduced sensitivity to spatial crowding. For students living alone, the spatial component might

take on more importance. We expected that for students living alone, rooms higher in usable space would be judged as more spacious and less crowded than other rooms. Further, personalization (as a possible measure of territorial claim) was expected to differ across the conditions such that more personal markings would be found in rooms high in usable space or low in crowding than in other rooms.

Second, while both Schiffenbaur et al. (1977) and Mandel et al. (1980) examined two kinds of natural lighting--direct and indirect sunlight--here a third condition--shadow--was added. Rooms in shadow were expected to be judged as darkest, smallest and most crowded; rooms in indirect sunlight--as lighter, larger and less crowded; and rooms in direct sunlight--as lightest, largest and least crowded.

Third, this study centered on graduate students from around the world. People from different cultures have different conceptions and experience with space, and different reactions to living in high density conditions (Hall, 1961; Rapoport, 1977; Schmitt, 1963). If despite these differences similar patterns of response emerge, they may well represent universals. It was our hypothesis that despite the international sample, differences in usable space would produce differences in personalization, perceived spaciousness and crowding, and differences in natural lighting would affect perceived lightness, spaciousness and crowding.

The international sample also allowed for comparisons

between the groups. Hall (1966) indicates cultural differences in space conception: Middle Easterns, Mediterraneans and Latins (henceforth called Mediterraneans) are contact-oriented cultures, to whom physical barriers are more important to the regulation of interaction. Asians are non contact cultures, in which social barriers are more important to regulate interaction. So in response to the same size dorm room, Mediterraneans would feel more crowded and Asians less crowded. Adaptation level theory (Helson, 1964) also indicates that Asians would feel less crowded than Mediterraneans. According to the theory, individuals respond to stimuli based on their prevailing level of adaption. Effects of adaptation level on environmental perception were confirmed by Wohlwill and Kohn (1973). In agreement with this theory, Rapoport (1977) indicates that crowding relates to exposure to physical density above the norms for a setting. Because the typical home size in Asia is smaller than that in the Mediterranean, respondents from Asia would feel less crowded than Mediterraneans. North Americans are left out of this discussion, because their responses might be confounded: Because they are the only group residing in their native country, factors such as familiarity and ability to escape to family might affect their experience.

In summary, this research examined four questions:

1) Do males and females living in similar conditions show similar patterns of response to those surroundings?

2) Are rooms higher in usable space judged as more spacious,

less crowded and more personalized than rooms lower in usable space?

3) Do increases in room exposure to outdoor light relate to increases in rated lightness and spaciousness and personalization, and decreases in rated crowding of the room?

4) Do Asians would judge their rooms as less crowded than do Mediterraneans?

METHODOLOGY

Setting

The setting for this research was Jones Tower, a 13-story graduate-student dormitory at The Ohio State University. This dormitory has a T-shaped plan with south-facing rooms in direct sunlight, north-facing rooms in indirect sunlight and east- or west-facing rooms in shadow. Each floor has 36 single rooms (2.9 m. wide, 4.5 m long and 2.8 m. high) and two double rooms. The dorm had 499 residents.

Place Figure 1 about here.

Subjects

Eighty single-room residents were selected at random and contacted. Dropped were 10 who either did not elect to participate, did not complete the questionnaire correctly or did not come from one of the three cultural areas dilineated. The resulting sample included 28 females and 42 males, 25 North

Americans, 26 Asians and 19 Mediterraneans, 27 with south-facing rooms, 22 with north-facing rooms and 20 with east or west-facing rooms.

Design

Room ratings, gleaned through the questionnaires, were treated as the dependent variables. The independent variables included both physical characteristics of the rooms and selected characteristics of the respondents. Two experimental conditions which centered on the room included natural lighting and usable space. For natural lighting, respondents were classified depending on room location into one of three conditions: (a) Shadow (east or west), (b) Indirect Light (north), and (c) Direct Sunlight (south). For usable space, respondents were classified depending on bed location into one of two conditions (see Figure 2): (a) High Usable Space (bed by window), (b) Low Usable Space. When by the window, the bed has its length facing the larger part of the room. This created more social space. When opposite the closet, the bed has its length facing a narrow space, primarily usable for circulation. The assumed difference in usable space was tested by examining the frequency with which respondents selected each of the two possible configurations as the more spacious. As expected, the rooms in the High Usable Space arrangement were more frequently selected as more spacious than the rooms Low in Usable Space ($\underline{X}^2 = 4.64$, 1df, $p < 0.01$). Still, more respondents ($\underline{X}^2 = 18.06$, 1df, $p < 0.01$) reported

having the Low-Usable-Space arrangment.

The experimental conditions which centered on characteristics of the respondents included gender and culture. Respondents were classified accordingly as either male or female, and as belonging to one of three broad cultural groups: (a) North American (United States, Canada and Northern Europe), (b) Mediterranean (Middle East, Latin or Mediterranean), and (c) Asian (Japan, Taiwan, China, Korea, Thailand and India.

Because each of the experimental conditions were expected to affect room ratings, for each test, the distribution of respondents by each level of the other conditions were made equal through eliminating the data from between 5 and 14 of the respondents.

Procedure

Questionnaires were brought to the rooms, and residents were told that if they agreed to participate, the questionnaire would be left for them to complete within a week for collection. The instrument contained nine five-point scales referring to characteristics of the room including its lightness (light-dark), size (larger-smaller than other single rooms in the dorm, narrow-wide, small-large, unproportional-proportional), crowding (comfortable-uncomfortable, stressful-relaxing, restricted-free to move and unpleasant-pleasant) and personalization. For personalization, respondents were asked to select from five drawings depicting different amount of wall hangings the one which best fit the amount of wall posters and hangings in their room. The

positive poles of the scales were assigned at random to either 1 or 7 to reduce response set. Respondents were instructed to indicate their sex, nationality, and which of various pieces of extra furniture (such as TV's, stoves, plants etc.) they had in their room. They were also asked to indicate room location (on a diagram like that in Figure 1), bed location (on a diagram showing the two practical locations--by the window or opposite the closet) and which bed location made the rooms look more spacious.

Principal component factor analysis (varimax roatation) was used to condense the room rating for use the the analyses. Three significant factors (eigen values greater than 1.0, explaining 35, 15, and 12 percent of the trace) and three index variables (each with highest loading on one factors) were selected. Factor 1, labelled Crowding, had four scales with substantial loadings (above 0.50) on it: stressful-relaxing (0.80), uncomfortable-comfortable (0.78), pleasant-unpleasant (-0.76), restricted-free to move (0.68) and large-small (-0.53). Stressful-relaxing was chosen to represent this factor. Factor 2, labelled Relative size, had one scale with a substantial loading: larger-smaller than other rooms (0.83). This item, like both Schiffenbaur et al.'s and Mandel et al.'s measures of physical density was retained. Factor 3, Lightness/width, consisted of two scales: dark-light (0.89) and narrow-wide (0.71). A fourth factor had one variable with substantial loading: amount of wall pictures (0.87). Despite the insignificant eigen value, this factor was

retained for its comparability to a personalization measure used by Mandel et al. (1980).

Window direction

Rooms in Direct Sunlight were expected to receive the highest ratings on lightness, spaciousness and personalization, followed by rooms in Indirect Sunlight and then rooms in Shadow. Also variations in sunlight were expected to affect rated crowding. The analyses of variance confirmed the expectations for rated lightness and personalization ($F = 5.52$, 2df, $p < 0.01$; $F = 3.52$, 2df, $p < .05$). Rooms in Direct Sunlight rooms were rated as being the lightest and as having the most personalization; rooms receiving Indirect Sunlight were second on each scale; and rooms in Shade received the lowest scores on each scale. Correlations between the various measures were also examined. Rated darkness (light-dark) had a significant inverse correlation with width (narrow-wide) ($r = -0.38$, 63 df, $p < 0.01$) and a significant direct correlation with crowding (stressful-relaxing) ($r = -0.23$ 63 df, $p < 0.05$).

Usable space

Usable space was expected to affect judged room size, crowding and personalization. Rooms High in Usable Space were rated as slightly higher in personalization than rooms Low in Usable space ($F = 3.69$, $p = .05$). A sex x usable space effect indicated higher ratings of personalization for females in High Usable Space rooms and lower ratings for males in those rooms as compared to the other rooms ($F = 4.34$, 1df, $p < 0.05$), For

crowding, the High and Low Usable Space rooms differed in the expected direction, but the difference only approached significance (F = 2.74, 1df, p = .10).

Resident characteristics

The males and females did not display any differences in response, except for the one interaction reported above for personalization x usable space. Otherwise, the patterns reported above for the full sample also appeared for the males and females separately. The comparisons by culture revealed the expected differences in crowding for the Asians and Mediterraneans. North Americans rated their rooms as significantly less crowded than did the other groups; and the Asians rated their rooms as significantly less crowded than did the mediterraneans (F = 3.13, 2df, $p < 0.05$). Because the different nationalities might have had different amounts of extra furnishings in their rooms, analyses of covariances (with number of additional furnishings treated as a covariable) were undertaken. These analyses revealed the same effect of culture on crowding (F = 3.17, 2df, p = .05). Separate comparisons of each group with each other group confirmed the pattern (p's < 0.05).

STUDY 2

One important physical factor identified by both Schiffenbauer et al. (1977) and Mandel et al. (1980) was floor height. Schiffenbauer et al.(1977) found that for the females, rated room size increased with building floor. Mandel et al.

(1980) (for floors 2-6) found gender differences in effects of building floor: The females exhibited the same pattern found by Schiffenbauer et al. (1977), but among males, perceived room size was inversely related to building floor. Mandel et al. (1980) concluded that sex differences in the use of the rooms (time spent and amount of window coverage) produced the different effects. Again, because the two groups lived in different dorms, it remains uncertain whether the reported differences resulted from differences between the groups, or from differences between the buildings. It was our expectation that males and females living in the same dorm would have similar patterns of response. Because Mandel et al. (1980) found the room ratings related to differences in the quality of the view, in the amount of time spent in the room and in the amount of time with window shades open we assessed these variables as well. Added was a question regarding the amount of time doors were left open.

Also considered here were the two aspects of crowding--social and physical. Mandel et al. (1980) found that females more often than males chose physical- over social-crowding as closer to their definition. This suggests that the absence of effect of space on crowding reported by Schiffenbauer et al., (1977) may have been unique to females--more sensitive to social crowding. Here, males and females in the same building were compared for their emphasis on physical vs. social crowding. It was expected that males and females would display similar emphases: Living in single rooms, they would select <u>spatial</u>

crowding as closer to their definition. The social/physical crowding variable also had relevance to the cultural differences found. One explanation of those differences suggests that the groups differ in their emphasis on social vs. physical aspects of their surrounding. An alternate explanation had to do with differences in adaptation level. If the groups are alike in the kind of crowding they emphasize, then the differences in perceived crowding more likely result from differences in adaptation level.

Mandel et al. (1980) report an optimal level of stimulation occurring between height and view. The Wohlwill (1974) optimal level hypothesis suggested that the amount of wall hangings/posters (stimulation) is adjusted in response to the stimulation of the view outside. With increases in the rated quality of the view, Mandel et al. (1980) observed fewer wall hangings. In the first study here, personalization was observed to vary with floor height and with room location relative to sunlight. Perhaps these variations related to the quality of the view.

In summary, this study centered on three questions: (1) Did males and females have similar patterns of response to floor height? (2) Did different groups of respondents differ in their definition of crowding--physical or social? and (3) did the amount of personalization vary in a way consistent with an optimal level theory?

Subjects

117 residents in Jones Tower participated voluntarily in this study. This sample had 53 females and 64 males, 56 North Americans, 29 Asians and 26 Mediterraneans, 38 in south-facing rooms, 40 in north-facing rooms, and 38 in east or west-facing rooms, 37 living on lower floors (1-6) and 80 living on higher floors (7-13).

Procedure

Two years after the previous study, the revised questionnaire was distributed to all mailboxes of students living in single rooms in Jones Tower. Students were insured confidentiality. They were asked to complete the questionnaire and to fold and return it (pre-addressed and free) via campus mail. The response rate was about 25 percent. Certainly, those who responded may differ from the others.

This questionnaire requested ratings of the room on selected five-point scales representing the factors in the first study: larger-smaller than other single rooms in the dorm, stressful-relaxing, light-dark, and personalization. In addition, the two kinds of crowding--spatial and social--and the view were assessed. As was done in Mandel et al. (1980), residents were asked to indicate which of the two definitions of crowding was closest to theirs: Social crowding (where there are too many people around who may distract you from studying by making demands on you to be sociable or by making too much noice), or physical crowding (where there is too little space, or not enough room to move around, study, etc.). The order of the choice was

switched for half of the respondents to mitigate order effects. Respondents were also asked to rate the room on the scales: physically crowded-uncrowded, and socially crowded-uncrowded, and good view-bad view. The order of all the questions was varied to mitigate order effects. Respondents were asked to indicate separately for day and night how many hours they spent in the room, how long they keep their door open and how many hours they kept their shades open. Also requested were the respondent's sex, nationality, room location (on a diagram like that in Figure 1), floor height, and length of tenure in the dorm.

Building Floor

Increases in floor height correlated with enhanced ratings of the view (good view-bad view) for the full sample ($r = -0.26$, $p < .05$), the males ($r = -0.23$, $p < .05$) and females ($r = -0.29$, $p < 0.05$) and with increases in crowding (stressful-relaxing) for the full sample ($r = -0.18$, $p < 0.05$) and for the males ($r = -0.25$, $p < 0.05$). As floor height increased, females reported spending less time in their rooms at night ($r = -0.30$, $p < 0.05$) but keeping the shades open longer hours at night ($r = 0.36$, $p < 0.01$). For the full sample, a correlation only approaching significance revealed that as floor height increased the number of hours that shades were open increased ($r = 0.17$, $p = .06$). Analysis of variance comparisons between responses from lower floors (1-6) and respondents on higher floors (7-13) and between males and females revealed no significant main effects or interaction effects.

Physical vs. Social Crowding

The responses of males and females to the various measures of crowding were compared. Males reported feeling more physically crowded than did the females ($F = 4.64$, 1 df, $p < 0.05$). For the full sample, more people selected physical over social crowding as the measure closest to their own definition ($X^2 = 11.33$, 1,1df, $p < .01$). Separately by sex, physical crowding was selected over social crowding more frequently by males ($X^2 = 10.24$, 1df, $p < 0.05$) and by females--only marginally significant-- ($X^2 = 2.88$, 1df, $p = 0.09$).

For each cultural group, the most frequently selected measure of crowding was the physical over the social ($X^2 = 4.82$, 1df, $p < 0.05$, Asians; $X^2 = 33.47$, 1df, $p < 0.01$, North Americans; $X^2 = 7.50$, 1df, $p < 0.01$, Mediterraneans).

Quality of view

The results revealed that the quality of the view was rated best in the north (2.95), followed by the south (2.91) and then by the east or west (2.0) ($F = 8.45$, 2df, $p < .001$). Paired tests revealed that only the comparisons between the North and East/West or the South and East/West were significantly different. With increases in height, the quality of view improved for all of the rooms studied ($r = 0.26$, $p < 0.01$), and for the south rooms ($r = .36$, $p < 0.05$). In addition, in south-facing rooms, increases in floor height correlated with increases in the amount of time shades were kept open during day and night ($r = 0.39$, $p < 0.05$) (perhaps another indication of the improved

view), and increases in the personalization of the room ($r = -0.33$, $p < .05$).

DISCUSSION

These results enrich those of Schiffenbauer et al. (1977) and Mandel et al. (1980) in several ways. Again, factors other than actual space appear related to rated size and crowdedness. Of course, care should be taken in interpretting these results as applicable to different kinds of populations in other environmental contexts. Consider the findings.

First, the expected effect of sun exposure on perceived lightness was confirmed; and in contrast to Mandel et al. (1980), here the increase in rated lightness as a function of increased sun exposure was found for both sexes. In addition, the expected effects was found across a third condition--shade--not tested in the earlier studies. These findings suggest that the sex differences found by Mandel et al. (1980) may have resulted from differences in the buildings. Did the differences in lightness produce differences in perceived spaciousness or crowding? Schiffenbauer et al. (1977) found crowding and sunlight exposure related, and Mandel et al. (1980) found lightness and perceived size correlated. Here, the results, at first, appear mixed. On the one hand, the natural lighting conditions did not affect either perceived size or crowding. On the other hand, correlations between lightness, size and crowding achieved significance in the expected directions. On closer examination, these findings do not support effects of natural lighting on size

or crowding. First, a more extreme variation in sunlight exposure--the Shadow condition--was included, and the quality of the view improved from Shade to Indirect Sunlight to Direct Sunlight ($F = 8.45$, 2df, $p < 0.01$). Still these conditions did not affect ratings of spaciousness or crowding. While significant correlations were found, they may not indicate causality. In fact, considering the absence of effects of the lighting conditions, the correlations more likely result from semantic- or scale- artifact rather than an environmental effect. If so, perceived spaciousness and crowding are not affected by variations in natural lighting.

Second, the data for usable space confirm Schiffenbauer et al.'s (1977) finding for females and extend them as applicable to males. Rooms having more usable space were judged as being more spacious. The results also suggest that the impact of spatial factors on crowding may depend on the amount of social stimulation--the presence or absence of others. In contrast to Schiffenbauer et al.'s (1977) results for double rooms, the results here for single rooms, support the relationship between either actual or perceived space and crowding: Rooms high in usable space were rated as less crowded and higher in personalization than other rooms. Amount of wall hangings and posters in rooms may result from many factors such as the amount of wall space available for posting in the different conditions or arousal level, but it may result from comfort with the room. It, too, varied with usable space: There were more wall hangings

in the High Usable space rooms.

Third, the expected differences between Asians and Mediterranians in perceived crowding were supported. While these groups did not differ in their ratings of lightness, size or personalization, they did differ in their rating of crowding. As was predicted by adaptation level and cultural meanings of space, the Mediterranians reported higher levels of crowding than did the Asians. Because the groups were alike in their preferred definition of crowding, the adaptation level explanation is the more plausible explanation.

Fourth, the data for view and personalization partially confirm the optimal level hypothesis. On the south side of the building--the only room location where increases in floor correlated with increases in the quality of the view--decreases in the amount of wall hangings also correlated with increases in floor. However, for the full sample, increases in building floor, while related to improved quality of view did not correlate with personalization. Perhaps the effect was confounded by room location effects. These effects also support the optimal level view. The view from rooms on the South and North were rated as significantly better than the view from the East/West, and the amount of personalization was significantly lower in the South and North rooms than in the East/West rooms.

As a whole, the findings give additional support to the importance of considering environmental context. Findings in one environment may have little applicability to other environments,

even though the environments are the same kind of setting. Given this conclusion, any recommendations for design or managment based on this research are tentative. Examinations of a variety of dormitories and examinations of the effects of specific manipulations are needed. In addition, research should address other populations (such as prisoners, or elderly in public housing) who have long occupancy and little control over their environment. For these, as for the students, the identifications of non-spatial variables which make a space feel enlarged and less crowded may help improve quality of life. Until such studies are done, we offer some tentative conclusions. Variations in exposure to sunlight and floor height may only affect perceived lightness and view, not perceived space or crowding. Still, improved lighting and view may be desirable. Perceived crowding may be reduced and perceived spaciousness increased through manipulations of usable floor space and through room assignments based on resident sensitivities to physical density.

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Figure 1

Jones Tower with rooms classified according to sun exposure